An Electronic Marketplace With Negotiation Supports

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To me, and you.

Abstract

Negotiation is essential in supporting complicated business transactions, especially in real estate and used cars. However, most existing electronic market systems are lack of such negotiation supports, resulting in low transaction ratio and low market efficiency. We, used the property industry as our test bed, developed a prototype of an electronic marketplace with negotiation supports. In order to support negotiation process, we set our focus on two aspects: information enabling and information supply, to support the computer-mediated negotiation process.

In this paper, we first define the process of transaction in real-estate industry and the steps involved in each stage of the process. Our model for negotiation was based on such definition, which emphasizes the important role of negotiation in the whole transaction process. After identifying the characteristics of negotiation, we then define the mechanism and rules to support such negotiation.

The performance of the proposed system has been tested by subjects with simulated transaction process. Experimental results indicated that computer-mediated negotiation has significantly improved the quality and efficiency of transactions that need such support.

摘要

在復雜的商業交易中，協商（negotiation）佔著非常重要的角色，尤其是在於物業及二手汽車市場裡。可是，大多數現有的電子交易市場都欠缺協商功能，因此導致市場成功率及市場效率都偏低。我們就選擇物業市場，建立一個能夠支援協商功能的電子市場系統原型。在支持協商過程中，我們把焦點集中在兩個範疇：資訊授予和資訊提供對於支持電腦化協商過程的重要性。

在本論文中，我們首先就物業市場的交易過程和每一個交易過程中所牽涉的步驟下了定義。我們以這個定義作為基礎，從而建立一個協商模型（negotiation model），將「協商」在交易過程中所扮演的重要角式突顯出來。根據談判過程的特質，我們定義出交易過程的機制及規則，和電子交易系統的詳細功能。

我們透過用戶模擬買賣物業去測試系統的可用性，而測試的結果亦証明了電腦化協商技術於在線式商業（online business）中的高度可行性，以及改善了市場交易的質素和效率。

Acknowledgements

I heartily wish to take this opportunity to express my deepest gratitude to those who have generously offered me help throughout my research. Without their continual support over the past two years, this thesis can never be accomplished.

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Words alone cannot express the thanks I owe to my dearest family, for their precious love and care, deliberation and endurance. For all my life you will be my inspiration and I love you all.

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CHAPTER 1

1. INTRODUCTION

The development of e-commerce has made a radical change in how market transactions took place. Computer-mediated negotiation is important that it supports complicated e-commerce activities, such as, real estate and used cars, to bring disagreements into business transactions.

With the advent of e-commerce, online business, such as, on-line auction and on-line trading, have become much more popular than before [1]. Placing online orders, making payments electronically, and finding information about the products and their vendors have become easier. Despite the comfort that e-commerce provides, humans are still involved in most of the important steps of large transactions, particularly in the property market.

Most business transactions in e-commerce involve negotiation to search for the most suitable price for both parties. During negotiation, each party has to collect information and makes decision based on the market condition, such as supply and demand, to achieve their objectives. However, majority of the e-commerce systems do not provide negotiation supports. In order to increase the successful rate of transactions, it is important to provide computer-mediated negotiation for those existing systems that support complicated business transactions.

1.1 E-commerce in Real Estate

E-commerce systems with negotiation support can be best used and tested in the real estate industry which involves a lot of the market-intermediaries and is highly affected by technologies' changes as well as its information-intensive, information-driven, high-value and asset-specific nature [2].

The rapid development of information technology and the successful evolutions of other industries have motivated the real estate agencies to use Internet as additional channels of reaching their customers. Several systems have been developed to support property markets. However, they do not support computer-mediated transactions. Rather, they only assist in information provision, such as listing and searching.

1.2 Need for Negotiation Supports

Negotiation is essential in supporting business transactions. However, for majority of the existing electronic market systems, once the traders enter their asks or bids into the systems, they can not communicate with each other, nor negotiate for better prices as they are not allowed to revise their offers. Such rigidity results in low transaction ratio and low market efficiency.

Also, some market participants would suffer significant loss if they cannot execute transactions promptly [3][4]. For example, the failure of immediate transactions would be disastrous to the sellers of the perishable goods, such as, cut flowers and tickets for some scheduled events [5][6][7]. Therefore, it is important for those electronic markets to provide channels to support negotiation or mechanism to support modification of offers.

Among all other industries, negotiation has been the most critical and time-consuming process for the real estate industry. More significantly, negotiation between the buying and selling parties solely relies on the coordination of the property agents. However, the existence of the middlemen does increase the cost of transactions and decrease the market efficiency. It also creates such problems as asymmetric information among the negotiating parties.

1.3 Need for Real-time Information

Negotiations always involve collection of substantial information to support decision analysis and decision making. It is also important to improve the existing market systems to provide tools to support searching, collection, and assimilation of market information. Otherwise, the market participants would suffer losses if they make predictions on the market movements based on incomplete information.

Hong Kong property market is sensitive to the environment. Sometimes, the spread of breaking news and rumours would result in a wide fluctuation, says 10 percent, of the property price within one day. In order to create a stronger position in negotiation, it is important to obtain a complete and most up-to-date picture about the current market condition. Therefore, the access to the real-time information, such as on-line news articles, has become essential to the players in the property market.

1.4 Motivation and Research Contributions

In regard to the above issues, we were motivated to develop a prototype of electronic marketplace in the real estate industry. The idea of "disintermediation" has also raised our interests in proposing a model for direct negotiation between seller and

buyer. Moreover, with the unique characteristics of the property market, our work should be able to demonstrate the significant effects of negotiation supports.

The contributions we achieved from the research are summarized as follows.

- We revise the traditional definition of transaction process for the property market.
- We devise a model of negotiation. Negotiation between seller and buyer is direct and without the need of a middleman.
- We implement a prototype of electronic marketplace with computer-mediated negotiation supports.
- We investigate how the integration of both textual and numerical information supports negotiators to better perceive the market in order to attain more satisfactory decisions.
- We evaluate the effectiveness of the system in improving the quality and efficiency of online transactions.

1.5 Organization of the Thesis

The rest of the thesis is organized as follows. Chapter 2 discusses the previous and current issues related to electronic market systems, middlemen and negotiation support systems. Chapter 3 presents our definition of a transaction process for the property market. There is a detailed description of the model for negotiation in

Chapter 4. Chapter 5 discusses the information needed for negotiation. In Chapter 6, we introduce our proposed system implementing the negotiation model. Chapter 7 discusses the experiment for our investigation using the system. Finally in Chapter 8, we finish the thesis with some concluding remarks.

CHAPTER 2

2. LITERATURE REVIEW

In this chapter, we first introduce the electronic trading markets and their evolution over the last decade. We also discuss the insufficiency of those markets in endowing with negotiation supports to the traders. In exploring the significant role of middlemen as well as the problems arisen with their existence, we identify the features and functions that should be supported by the trading markets for the purpose of disintermediation. Besides, we investigate some existing negotiation support systems and try to apply their entailed mechanisms to support negotiation in our proposed electronic marketplace.

2.1 Electronic Markets

The electronic market effect occurs in the case of computer-based markets where information technologies serve as the intermediaries between multiple buyers and suppliers [8]. Acting as a broker or a dealer, an electronic market allows consumers to purchase products or services electronically without contacting a large number of vendors individually [9].

Electronic marketplaces are of increasing interests around the world since they are more advantageous than those conventional markets in many ways. The use of information technology has significantly reduced the costs incurred for the transactions, from searching for a trading partner, to the settlement of transaction, such as the payment matters [10]. Web-based computer-mediated market systems also provide an access to virtually everyone on the Internet, at any time, thus supporting round-the-clock global markets [11]. In addition, electronic markets provide regulatory services such as electronic audit and surveillance [12].

2.1.1 Classifications

Regarding the type of an electronic market, there are basically four categories: direct search market, dealer market, auction market and clearinghouse [7]. For our study, we focus on clearinghouses. Clearinghouses can be further classified into continuous

markets, such as the stock markets of New York Stock Exchange (NYSE) and Stock Exchange of Hong Kong (SEHK), and periodical markets, such as the flower markets in Netherlands.

Most existing electronic market systems only support relatively stable markets in which the utilities and assets of the traders are fixed. In those stable markets, transactions occur only when traders' buying and selling intentions, which are fixed and explicitly expressed, match with each other. However, in reality, most of the trading markets are dynamic markets, in which immediate transactions are significantly important. Therefore, market participants are likely to change their goals or utilities in respond to the volatile market conditions in order to make successful transactions.

2.1.2 Evolution of market systems

For the last decade, traditional market systems have been substituted by a large number of electronic ones. Computer reservation systems, such as SABRE or Apollo, have already evolved from a single sourced marketing channel into an electronic market system [13]. FAST, a computer network broker system for electronic parts and components, is designed to help buyers locate and transact with the vendors who offer the best price [14]. In Japan, AUCNET has been introduced for trading used cars through TV terminals [15]. Computer on-line shopping systems, such as

CompuServe's Electronic Mall, have established a prosperous customer base by connecting their networks with the Internet, which has become a de facto information superhighway [16]. After the merging of Home Shopping Network and QVC, the retailing sales of TV home shopping systems have been tremendously increased, and have even created the potential threats to those conventional mail order companies [17].

Computer-based trading systems have also been making inroad into the financial and commodity markets. NASDAQ displays dealers' quoted prices onto a widely distributed electronic billboard system so that customers can execute transactions at the best dealer bid-offer quote for trading the over-the-counter securities [18]. The London Stock Exchange has also introduced a similar system, which is called SEAQ.

Some electronic market systems, such as CATS, Instinet, INTEX, SOFFEX and Globex, are even able to support fully automatic order matching process based on some predefined trading rules [19]. TELCOT, implemented by the Plains Cotton Cooperative Association, is an electronic market system for trading cotton spot [20]. EASE has been introduced in the United Kingdom in order to replace the conventional regional auction markets for agricultural products, such as cattle and grain [21].

In 1996, the RealSelect Inc. set up the Realtor.com, which has been managed by the National Association of the Realtors. The properties listed in the system constitute about 95% of the existing inventory in the US market. The Microsoft has also opened an on-line realty service [22]. In Hong Kong, some popular big real estate agents have set up their official websites on the Internet. They provide a variety of information such as transaction records, real time news and some analyses on the current market.

2.1.3 Future trends

Traditional electronic markets or brokers have been facing strong competitions. Reducing the transaction costs and providing better services have been the major challenges for the competitors. The value-added services, such as providing useful data and information, are one of the most important strategic weapons to gain competitive advantages, especially for the Internet stock brokerage firms. Different business models have been applied by those firms to create different incentives to attract customers. For example, Fidelity and Charles Schwab, two major on-line trading companies, have focused on such high-quality customer services as providing abundant information with a set of analytical tools to their customers, but costing

them for a rather high service charge. In contrast, some smaller firms, being unable to provide such premium services, compete with others by charging the customers with a much lower transaction cost.

Deregulation, open competition and disintermediation have become the trends of the market operations. In order to make the society more efficient and transparent – the two major sources of competitiveness, for those practices that are not contributive but increasing the costs to the market participants would be eliminated eventually. One notable example is the impact of the direct sales of airline tickets over the Internet to those traditional travel agencies whose major income has come from the sales of airline tickets. In order to survive, those companies have to identify more innovative value-added services, or to create a new business, to retain their customers.

2.2 The Middlemen

Every market transaction involves the processes of searching, coordination, negotiation and settlement. Searching regards to the efforts of a seller or a buyer to locate a suitable candidate for making a transaction. In a direct search market, sellers and buyers have to search for the counter party by themselves and then directly negotiate with them. However, the number of the candidates each party can reach is usually very small. In a broker market, such situation can be much improved with the

coordination of middlemen since they are able to establish connections with a pool of customers.

When trades become sufficiently heavy, middlemen begin to offer specialized searching services to market participants [23]. Charging for a fee, brokers try to find compatible trading partners for their clients. Moreover, brokers can easily locate the best deal between the sellers' offer and the buyers' bid since they are frequently in contact with many market participants. In order to attract customers, brokers provide such services at a lower price than the possible cost for the participants if they are to find trading partners by themselves in the direct search market. The extensive contacts with market participants allow the brokers to obtain abundant information on the products and the prices for which individual traders cannot economically duplicate. Since the fees for the broker, in the form of a commission, is normally lower than the cost of direct searching, traders are willing to make use of their services.

In reality, middlemen do not only provide their clients with the services of searching the trading partners and locating the best deal, but also extend to the coordination among them, such as negotiations and contract formations. Since the commission is based on the sales of the property, brokers are enthusiastic to initiate negotiations and give much advice to their clients in order to secure the transactions. For example, if the home buyer cannot find a property that satisfies their desired price

and location, the real estate broker will persuade them to relax their budget constraints or the preference on the location.

2.2.1 Middlemen for HK property market

The responsibilities of the middlemen in the property market in Hong Kong are much greater than that in other industries [24]. It is still a broker market, and the buying and selling of properties in Hong Kong involve quite a lot of legal issues. Thus, property agents and lawyers are needed, by the law, in the market. However, some of such regulations, in protecting the agents and lawyers, sometimes increase the cost for the transactions. Usually, the buyers and sellers have to bear such additional cost.

Apart from providing the legal supports, the property agents also need to help the sellers to list their property and assist the buyers to locate the most desired flat to negotiate for. Moreover, they coordinate the two parties for the negotiation process and assist in the settlement of transaction and even loans arrangements.

2.2.2 Information transparency and efficiency

Since the agents control the listing information, they enjoy a monopolistic or a cartel-like role in terms of information ownership, guaranteeing themselves a significant role

in helping buyer and seller to find each other [2]. During the negotiation process, as seller and buyer can solely depend on the agents, as the middlemen, for the exchange of information, the agents are able to obtain information from both parties. However, the seller and buyer are not able to communicate directly with each other, it thus creates the condition of asymmetric information among the three parties. Moreover, it also allows some dishonest agents to make additional profits by manipulating the information on hand. In other words, the property market in Hong Kong is not transparent and efficient enough. Consequently, the participants have to suffer high costs and eventually making Hong Kong less competitive than other countries, such as Singapore.

2.2.3 Impacts of IT to the middlemen

Although information technology has been successfully used to help the middlemen or agents to reach their customers, it has also created the threat of "disintermediation" to the traditional brokers. With the use of the information technology, sellers and buyers are able to bypass the middlemen to reach their counter parties directly. There would be a drastic change of the role of the middlemen in the real estate industry [22]. The traditional agents have to identify new business or new value-added services in order to survive in the evolving markets.

2.3 Negotiation Support Systems

Most of the electronic market systems only serve as the intermediary between the sellers and the buyers, eliminating the need to directly contact with a large number of trading partners. However, such systems mainly function to provide information of the trading partners to the participants, without any support for the communication and negotiation between the two parties. The coordination between the buyers and sellers has to be done by some traditional methods, such as negotiating on the phone, when they are not agreed on the transaction price.

Since the 1960s, the concept of computerized negotiation support has been evolved. Negotiation Support Systems (NSS) are computer assistance for negotiations. One of the approaches to create a Negotiation Support System (NSS) was to combine the Group Decision Support System with the Decision Support System. Some research has been conveyed to study how NSS could alleviate the major cognitive and social-emotional stumbling blocks. Perkins el. al. has conducted an experiment, with some purchasing managers as the subjects, to investigate the effects of computerized negotiation on the outcomes of the negotiations between the sellers and the buyers [25]. The results have indicated that, by using NSS, the manager could achieve better outcomes more time efficiently. NSS can also help users to handle the social aspects of negotiation, such as reducing the cognitive

conflicts, thus allowing them to focus more on the content and the analysis for the negotiation process.

There are a few systems, such as TELCOT, which support some primitive negotiations between the sellers and buyers. TELCOT coordinates the negotiation by allowing the buyers to forward a counteroffer to the seller [20]. However, it is being far from the active intermediary services that can be obtained from human brokers. There are some negotiation support systems for research or academic purposes and the ideas or mechanisms involved may be applied to the practical electronic systems. I-Help is a distributed multi-agent peer help system in supporting students in a university course [1]. Similarly to Kasbah [26], a one-to-many or many-many negotiation problem is modelled as a series of disconnected 1-1 negotiation problems. INSPIRE is a negotiation support system that can be used to study and teach bilateral negotiations [27].

Research on NSS has primarily focused on two key technological aspects: (i) group decision and/or conflict resolution models to help negotiators reduce discord and increase the chance of reaching consensus, and (ii) providing rich communications media to enhance communication exchange between antagonists [28]. Our work has focused on the latter one. Moreover, in order to support the dynamics of the market situations, real-time news are made available from different sources of information websites to support negotiation as well.

CHAPTER 3

3. TRANSACTION PROCESS

The transaction process in the real estate industry can be divided into five distinct stages: listing, searching, evaluation, negotiation, and execution [2]. In real cases, not all negotiations would successfully result in the execution of transaction. Whether or not an agreement can be attained greatly depends on the process of negotiation. In order to emphasize the significance of negotiation in a business transaction, we have revised the definition so that the transaction process only includes three main stages: (i) preparation, (ii) negotiation, and (iii) termination. Our proposed model for negotiation was devised based on these three stages of transaction.

3.1 Preparation

Preparation is the first stage in a transaction process. Sellers list their property's information, which enables buyers to perform search and comparison. At the same time, both parties need to submit their asking and bidding price for the property based on the current market conditions, with the access to substantial information. Until the buyers find a property that matches their own preferences, the negotiation would commence. Figure 3-1 summarizes the steps involved in the preparation process.

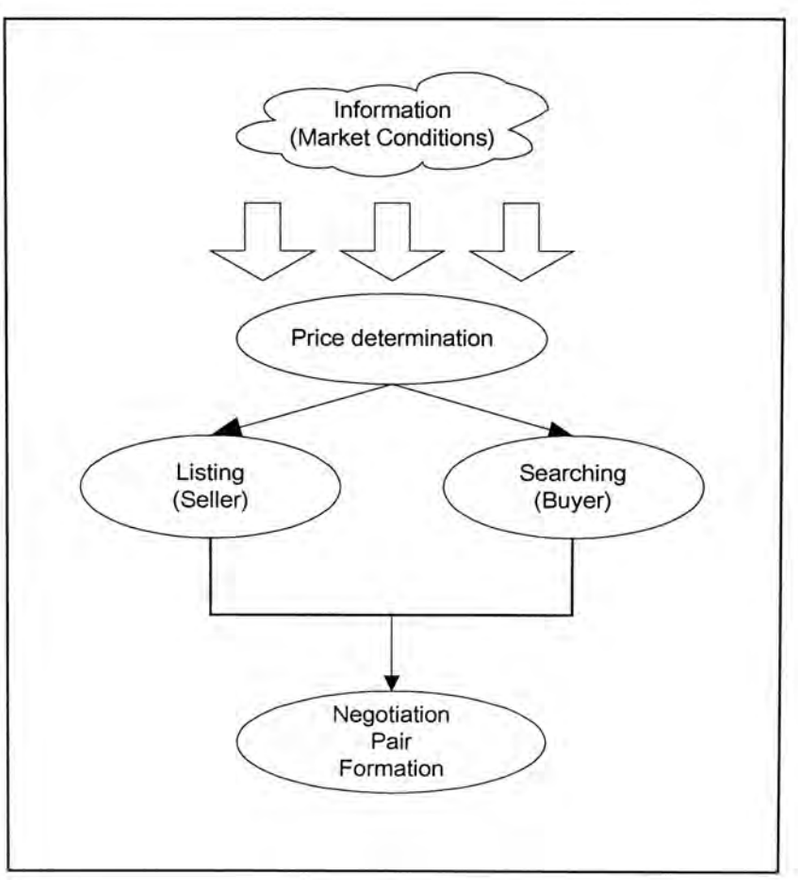


Figure 3-1. Preparation in Transaction Process

3.2 Negotiation

Negotiation is the second stage in the transaction process. Negotiation consists of three co-related sub-processes, namely evaluation, adjustment and concession. Evaluation involves information gathering from various kinds of sources, thus buyers and sellers can identify the current market situation efficiently. Adjustment is the result of evaluation. It supports the decision making of both the buyers and the sellers by altering their preferences on the limit and aspiration level towards the negotiation. Finally, concession is the outcome of adjustment. Both parties would then re-evaluate after making a concession in order to reach an agreement during negotiation. Figure 3-2 shows the overview of the negotiation process.

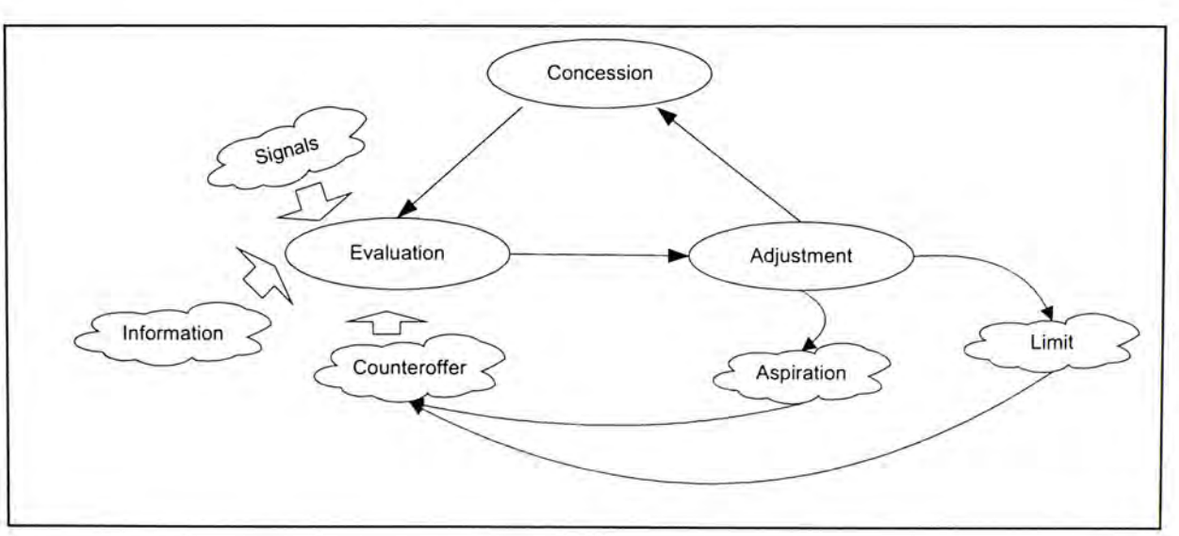


Figure 3-2. Negotiation Process

3.2.1 Evaluation

Before making each move for negotiation, a party would try to collect as much information as possible in order to support decision making. The main kind of information considered can be classified into the following three categories.

▪ Market Information
▪ Rating of Counteroffer
▪ Signals from Counter Party

Table 3-1. Information Involved for Evaluation

Market information allows the negotiators to assess the current market status, then to evaluate their own position in the negotiation. It requires accessing various kinds of information from different sources, such as daily news and transaction records, from newspapers, magazines, TV and the Internet. The rating of counteroffer is used to evaluate the counteroffer in regard to the limit and aspiration of a party for negotiation. Signals refer to the selective information sent by the counter party in order to create favourable impression or to encourage concession.

3.2.2 Adjustment

According to the result of evaluation, the negotiators may make some adjustments on their own preferences, that is, their limit and aspiration for the negotiation. For example, suppose a seller has set a very high initial ask price. However, the result of evaluation has indicated a decrease in the market price of the property. He would then lower both his limit and aspiration for the negotiating property.

The aspiration is the price at a particular time, that a party desires and hopes the other party to accept, whereas the limit refers to the worst price that a party would possibly accept. The limit and the aspiration are strongly related to each other. In general, the limit tends to remain constant over time while the aspiration level declines towards the limit in each concession.

3.2.3 Concession

Concession refers to the actual actions taken in negotiation, that is, changing the offer and signalling. The change of an offer is usually in a direction that increases the utility of the other party, or sacrifices his or her own interests or benefits. This is based on the concept of zero-sum game that, when one side makes sacrifices, the other side is believed to receive what he or she has sacrificed. Concession is

important to every negotiation for generating an agreement, preventing the other party from quitting the negotiation, and encouraging the other party to make reciprocal concessions.

Signalling is a way of communication for catalysing the process of negotiation. It involves the exchange of opinions between both parties in order to persuade the opponent to make sacrifice. Apart from their own standpoint, sometimes there would be information or news favourable to either party. For example, the news about the fall in the overall average price in the property market is favourable to the buyer to persuade the seller to lower his or her ask price. There is a more detailed discussion of the signalling game in the latter section.

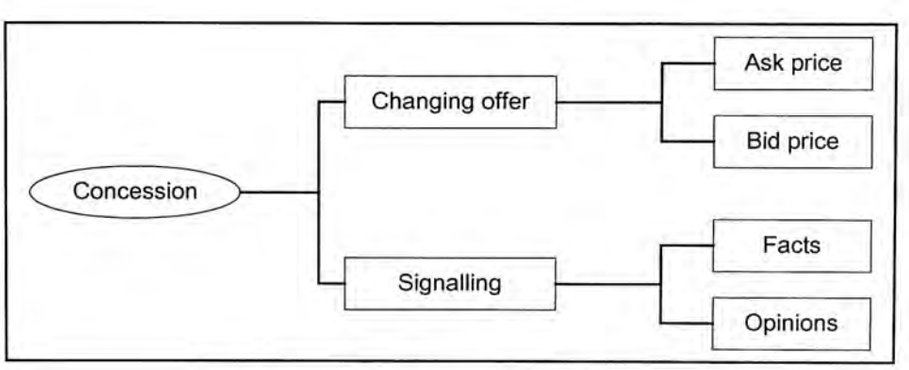


Figure 3-3. Concession Process

3.3 Termination

Termination is the third and last stage in the transaction process. A successful transaction process is terminated when an agreement has been reached between both parties. However, other negotiation pairs between the seller and other buyers, or the buyer and other sellers would cease at the same time. A transaction process is failed when the parties cannot reach an agreement during the negotiation process.

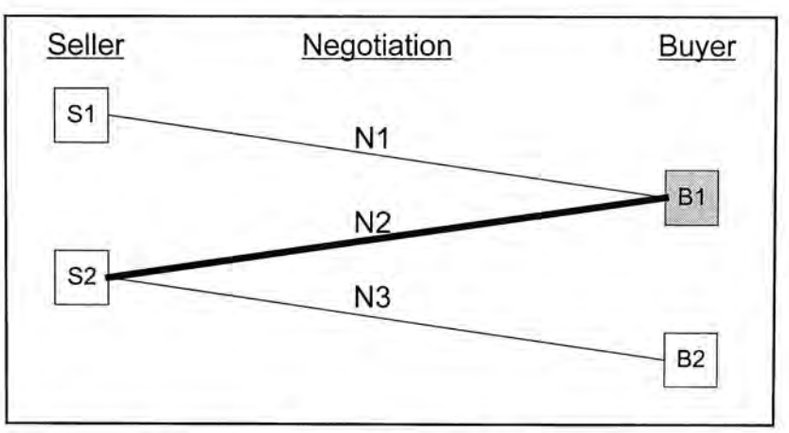


Figure 3-4. Termination of Negotiation

Refer to Figure 3-4 above, suppose the buyer B1 accepts the seller S2's offer and gives up the negotiation N1 with S1, then all the three negotiations would be terminated and their termination status are shown in Table 3-2.

Negotiation	Termination Status	Explanation
N1	**Quitted**	B1 quits the negotiation with S1
N2	**Completed**	Transaction is executed, between S2 and B1
N3	**Closed**	B2 loses in competing with B1 for S1's property

Table 3-2. Termination Status

CHAPTER 4

4. MODEL OF NEGOTIATION

4.1 Negotiation Process

Negotiation is the process in which buyers and sellers agree to a binding contract after a number of offers and counteroffers. It is an iterative process in which the participants make offers and counteroffers based on their own preferences [1]. This explanation may over-simplify the actual process of negotiation. In fact, negotiation is a complicated process involving a lot of strategies, analyses, and interactions among the participants. Negotiation accord is the result of multiple, intense and evolutionary negotiation processes, punctuated by streams of working agreements and disagreements.

It is very common for bargainers to start with a high bid well beyond their aspiration levels, in order to create room to concede in the latter stage of negotiation. In general, negotiators would become more cautious for making concession when their offers approach the limit or their bottom lines. From Figure 4-1, it is obvious that the curves of concession rates become flatter when they get closer to the limits [29].

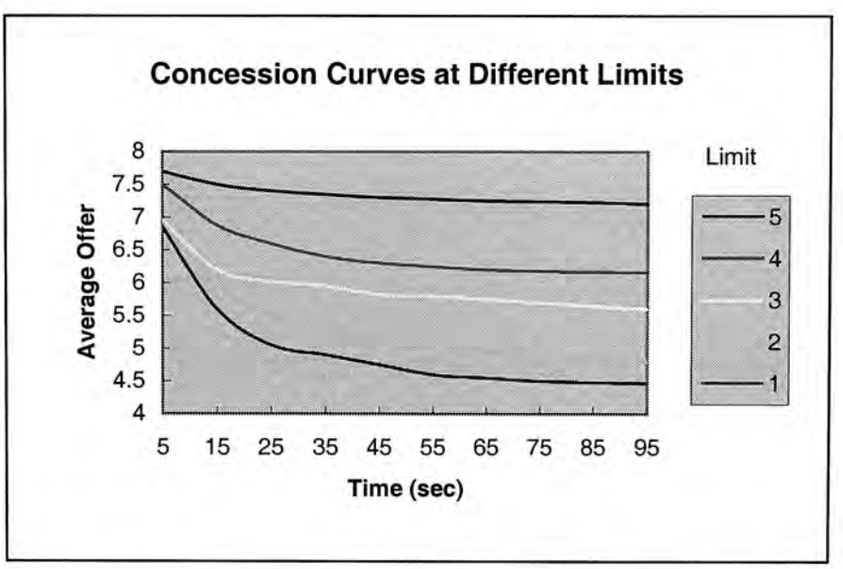


Figure 4-1. Concession Curves at Different Limits

Our proposed system aims at helping users evaluate each of their counteroffers with the use of the rating function and dynamic market information. A competitive environment is created through market signalling game and simultaneous negotiations with several counter parties. By using the system, users are expected to reach satisfactory solutions quicker and/or achieve better payoffs.

4.2 Direct Negotiation Without a Middleman

Traditionally, negotiation is characterized to be rather passive, intermediated, and only a single negotiation can be carried out at a certain time. Both buyer and seller rely solely on the agent's advice and seldom get involved in the negotiation themselves.

Although they would make the ultimate decision, it may not be the optimal one, especially for the buyer side. Normally the commission for an agent is a fixed proportion of the transaction price; therefore a higher transaction price is desirable to the agent. Moreover, in order to secure a successful transaction, the agent always try to persuade both parties to compromise instead of fighting for the best price for either side.

Nowadays, with the innovation of the industry in the electronic marketplace, the negotiation practice has also been transformed. With the trend of disintermediation, the agent's role and responsibilities would be gradually taken up by the seller and buyer themselves to make the process more efficient and controllable to both of them.

In our model, we assume negotiation between buyers and sellers is direct, and without an agent as the middleman. Therefore, the tasks of dealing with the counter

parties, evaluating the counteroffers, observing the market conditions, etc., have to be performed by themselves.

4.3 Two-Stage Negotiation Approach

In buying a property, there are many terms for which the two parties need to negotiate in order to make a successful transaction. In most cases, negotiators first settle the less important ones and then focus on the most important, which is usually the price. Instead of negotiating for all unmatched attributes, our system only supports negotiation of one attribute, that is, price of the property. Therefore, the negotiation can be regarded as a two-stage process.

Stage one is the searching and preparation. Properties are selected based on the total utility of their attributes according to the buyer's preferences. Stage two is the actual negotiation process for the most important attribute – the price of the property.

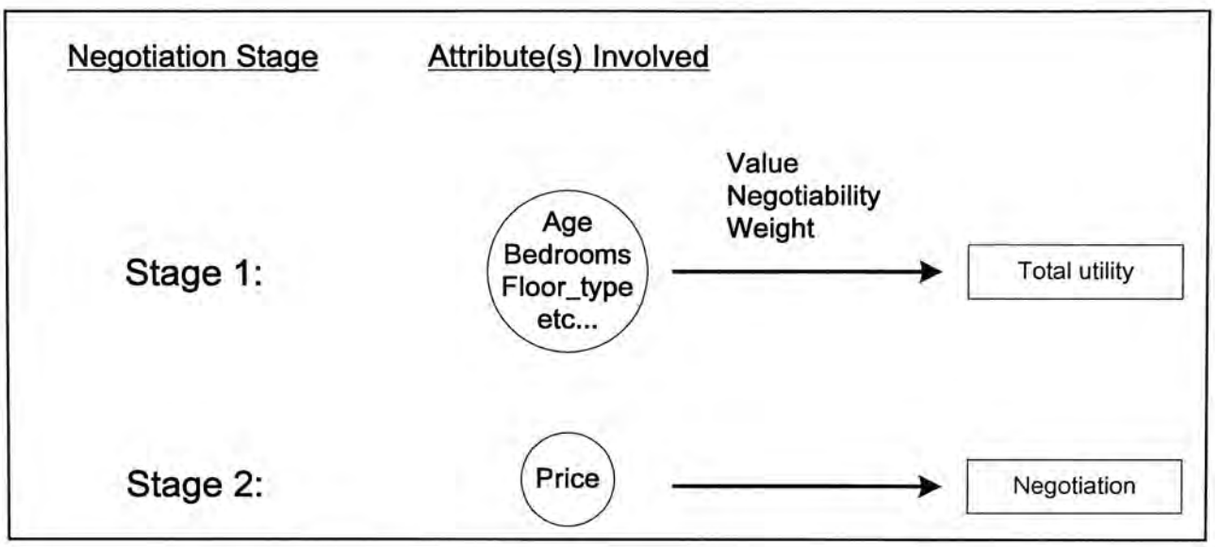


Figure 4-2. Negotiation Approach

4.4 Property Matching

Property matching is the mechanism devised for the property searching process in our system. It includes searching each selling property in our database, calculating the utility of their attributes according the buyer's criteria, and short-listing those successful properties.

4.4.1 Principles

We have defined a set of attributes as the criteria for each property and there are three elements concerned with each attribute:

1. The value of the attribute itself. For example, a value of 4 for the attribute "number of rooms" implies that the buyer is looking for a flat with at least 4 rooms.

2. The negotiability of the attribute. There are three levels of negotiability: "not care", "negotiable" and "non-negotiable".

Negotiability	Significance
Not care	Attribute is not concerned in the matching process.
Negotiable	Property may still be concerned even if the attribute does not meet the user's requirement.
Non-negotiable	Property will be omitted if the attribute does not meet the user's requirement.

Table 4-1. Significance of Negotiability

3. The weight of the attribute. It reflects the relative importance of the attribute with respect to all other attributes.

The value of the three elements is determined by the users according to their own preferences.

The purpose of the matching process is to find and list all selling properties that meet the buyer's requirements. It is determined by a single linear utility function,

which is calculated as the weighted sum of all attributes. A greater value of the utility function implies that the selling property is better matched with the buyer's criteria.

4.4.2 Process

According to the buyer's preference and requirement of each attribute, the system searches the database of selling properties for the feasible ones. The searching process is divided into the following three stages.

1. First round searching – the system searches for property which can exactly meet the buyer's requirement for each attribute.

2. Second round searching – if no property is found in the first round searching, the system would relax the conditions and continue to search for property with only some negotiable attributes not met the buyer's requirements. In most cases, it means price.

3. Third round searching – if the system is still unsuccessful to find any property in the second round searching, it will enter into this final stage. In this round of searching, even if a property has unsatisfied non-negotiable attributes, it would still be considered. But only those satisfied attributes and those unsatisfied negotiable attributes can contribute to the total utility of the property.

If at least one property is found in a particular round of searching, the following round will not be proceeded. The selected properties are ranked and listed in the descending order of their utility. Figure 4-3 shows the sample result in each round of searching.

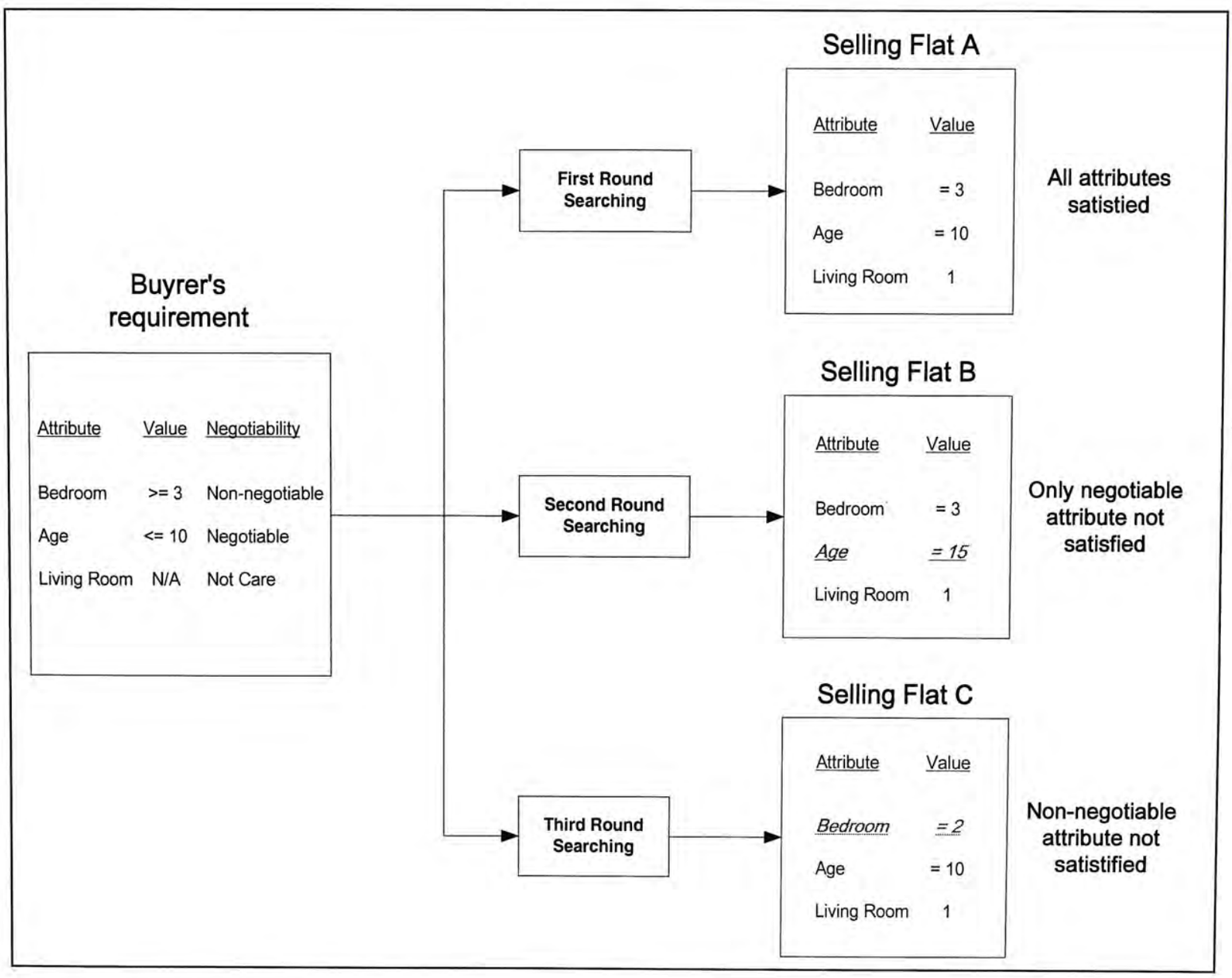


Figure 4-3. Sample Result of Different Searching Rounds

4.4.3 Utility function

4.4.3.1 Notation

The following table summarizes the symbols and their meanings, which are used for representing the algorithm of the matching process as shown in Appendix A.

Symbol	Meaning
s	Value of the attribute of a selling property
b	Desired value of the attribute according to the buyer's criteria
N	Negotiability
u	Total utility of a selling property
Non_neg	Count for unsatisfied non-negotiable attributes
neg	Count for unsatisfied negotiable attributes
W	Weight of an attribute specified by the buyer
W	Summation of ***w*** of all attributes except those of "not care" attributes
AS(s,b)	To determine if ***s*** matches with, or better than ***b***
θ	Contribution of the attribute to the total utility ***u***

Table 4-2. Notation for the Utility Function

Most of the attributes and their values for the selling property and the buying order are identical. However, there is an exception for the attribute "floor". For a selling property, the exact floor is entered when the seller registers his or her property into our system. However, in setting the criteria for the attribute "***floor_type***", there are only three possible values for buyer to select, those are high, middle and low. The values of ***s*** and ***b*** are not comparable as their semantics are different. Therefore, we have to classify the ***floor_type*** of the registered property according to its actual floor, which is presented in Table 4-3. In the matching process, we compare the ***floor_type*** of the property instead of its actual floor.

s **for floor_type**	**Actual value of floor**
High	> 19
Middle	11 – 19
Low	< 11

Table 4-3. Classification of floor_type

As described previously, there are three possible values for the negotiability, ***N***, which are non-negotiable, negotiable and not care. The numerical values to represent the three types of negotiability is shown in Table 4-4.

Symbol	Value	Meaning
N	2	Non-negotiable
	1	Negotiable
	0	Not care

Table 4-4. Value of negotiability

For the symbols ***non_neg*** and ***neg***, they respectively count for the number of unmatched non-negotiable and negotiable attributes in an outstanding selling property. The value of the two variables determines which round of searching would be achieved finally.

Searching Round	Conditions
Round 1	***neg* = 0 & *non_neg* = 0**
Round 2	***neg* > 0 & *non_neg* = 0**
Round 3	***neg* > 0 & *non_neg* > 0**

Table 4-5. Significance of *non_neg* and *neg*

AS(s,b) is used to determine if ***s*** satisfies ***b***. That is, if the attribute of a selling property satisfies the buyer's requirement. If ***AS(s,b)*** is true, it implies that ***s*** match

with, or better than ***b***. The conditions for ***AS(s,b)*** to be true for different attributes are summarized in Table 4-6.

Condition for AS(s,b) = TRUE	**Attribute**	**Characteristics of Attribute**
s = b	District, view, floor_type	Discrete, non-numeric value
s >= b	Living room, bedroom and gross area	Comparable, numeric value
s <= b	Age, bid price, reserved price	
s ∋ b	Facilities/Remarks	Inclusion or exclusion

Table 4-6. Conditions for AS(s,b) = TRUE

The value of θ accounts for the contribution of an attribute to the total utility ***u***. For those incomparable attributes, the value of θ would be either 0 for **AS(s,b)** is false, or 1 for **AS(s,b)** is true. However, for those comparable attributes, ***s*** would sometimes be better or worse than ***b***, which would result in the value of θ to be greater than or smaller than 1. The corresponding value for θ to different attributes is summarized in Table 4-7.

Value for θ	**Attributes**
1 or 0	District, view, floor_type, facilities/remarks
1 + (s-b)/b	Living room, bedroom and gross area
1 + (b-s)/b	Age, bid price, reserved price

Table 4-7. Value for θ

4.5 Rating of Counteroffer

Counteroffer is the price offered by the counter party in each round of the negotiation. Whenever there is a change in the ask price or the bid price, it is regarded as a new round of negotiation. The rating of counteroffer acts as an analytical tool for the user to evaluate the counteroffer in each round of negotiation. It calculates the degree of user satisfaction towards the counteroffer, based on user's own preferences for their desired price and reserved price. The rating is represented by a positive or negative value in percentage.

The calculation of the rating varies in different conditions of the counteroffer, reserved price and desired price, as summarized in Table 4-8 and Table 4-9. In most cases, the counteroffer falls between the reserved price and desired price, and its rating will be a value between 0 and 100%. A greater value of rating indicates a better counteroffer, as it is closer to the desired price. A negative value of rating indicates that the counteroffer is worse than the reserved price. In such case, the party would not likely to make further concession, nor to accept the offer from the counter party.

In some exceptional cases, the counteroffer is even better than the desired price and it will result in the rating with a value greater than 100%. The party would probably accept that offer immediately.

Conditions		**Rating (*100%)**	
		Calculation	***Value***
Counteroffer falls between reserved price and desired price	$P_d < P_c < P_r$	$\frac{(P_r - P_c)}{(P_r - P_d)}$	*0 - 100%*
Counteroffer better than desired price	$P_c < P_d$	$\frac{(P_d - P_c)}{P_d} + P_d$	*> 100%*
Counteroffer worse than reserved price	$P_c > P_r$	$\frac{(P_r - P_c)}{P_r}$	*< 0%*
Counteroffer just meets reserved price	$P_c = P_r$	-	0

Table 4-8. Calculation of Rating of Counteroffer for Buyer

Conditions		Rating (*100%)	
		Calculation	*Value*
Counteroffer falls between reserved price and desired price	$P_d > P_c > P_r$	$\frac{(P_c - P_r)}{(P_d - P_r)}$	*0 - 100%*
Counteroffer better than desired price	$P_c > P_d$	$\frac{(P_c - P_d)}{P_d} + P_d$	*> 100%*
Counteroffer worse than reserved price	$P_c < P_r$	$\frac{(P_c - P_r)}{P_r}$	*< 0%*
Counteroffer just meets reserved price	$P_c = P_r$	-	0

Table 4-9. Calculation of Rating of Counteroffer for Seller

where P_c = Counteroffer

P_d = Desired Price

P_r = Reserved Price

4.6 Recommendation Price

The recommendation price is the system-generated price for the reference of user in adjusting their ask/bid price. The calculation of the price is based on the bid price, the ask price and the market price of the negotiating property.

The recommendation price is calculated according to the following linear function.

$$\text{Recommendation Price} = \frac{(P_{bid} + P_{ask})}{2} * 0.8 + P_{avg} * Area * 0.2$$

where P_{bid} = Bid price

P_{ask} = Ask price

P_{avg} = Average unit transaction price

Area = Gross area of the property

A simple linear interpolation function is used to calculate the recommendation price. We assume the recommendation price to be consisted of two main elements. First is he mid-point between the offer and counteroffer, which is assigned a weight of 0.8 in the formula. Second is the average transaction price of the property in the past month, which is assigned a weight of 0.2. The weight can be adjusted based on the results of testing and/or aggressiveness of negotiators.

CHAPTER 5

5. INFORMATION NEEDED FOR NEGOTIATION

Information is particularly crucial in a relatively high-risk and unpredictable market, such as the property market. Market participants gather information to reduce uncertainties and to attain better decisions. In reality, it is impossible to obtain perfect information. There are so many factors affecting the movement of market, for example, results of land auction, and it is impossible to predict how these factors would move. We have to face the reality that market can be imperfect, incomplete, or asymmetric in information transmission.

Information concerned in the real estate market can be divided into two categories, textual and numeric. Textual information refers to all news articles about the property market while numeric information refers to the transaction data for the

property. The following parts describe the ways in obtaining and assimilating these two kinds of information.

5.1 Textual information

The news articles about the real estate are commonly found in different media such as newspapers, magazines and even the Internet. Since our system is a web-based application and for the sake of convenience, the source of information is restricted to the Internet. However, we can still presume that the information from the Internet alone should be sufficient to meet the needs of users. All the major Hong Kong newspaper websites and real estate agencies websites, such as, Mingpao.com, Appledaily.com, and Centaline.com, provide more than three hundred news articles each day.

As the Internet become more and more popular, many newspapers and magazines set up their official websites to publish their contents. So most of the content in the traditional mass media can also be found on the Internet. Moreover, the Internet has more advantages than other sources. For example, it is free and some websites update their contents several times a day. Normally, people only read one or just a few particular newspapers or magazines regularly. However, from the Internet, they can easily access much more information quicker. Additionally, the search

engines on the Internet allow them to look for particular information more conveniently.

The news articles downloaded from the Internet are stored into the database. The entire content of the news articles can be displayed to the user upon retrieval. Besides, we would also provide hyperlinks to some other sources of news articles so that the user can read news from those websites directly.

5.2 Numeric data

The official and centralized records of the transaction details of the real estates are available from the Hong Kong Land Registry. Although that database provides an extensive record of real estate transactions, it is neither common nor practical for the general public to access its information. This is because it charges a fee for obtaining such records, and it also involves complicated procedures for applying such service. Most of the property agents maintain their individual database of transactions. However, those records are usually constrained to the transactions executed through the same group of agents while excluding those from other agents. Therefore, it is not comprehensive at all.

Fortunately, the major property agents have already set up their websites on the Internet and the transaction records have been made available too. People can

easily search for the transaction data of their desired real estates from such websites. Some websites also provide statistical data in the form of charts for much easier interpretation of the data.

We have collected and consolidated transaction data from different websites and stored it into our own database. Instead of presenting the raw numerical data directly, we have transformed the data into graphs for better presentation. For each real estate, the monthly transaction data, such as the average price, maximum price, and minimum price, in the past year is displayed.

5.3 Signalling

Market signalling allows the situation with incomplete information to get closer to that with complete information. Signalling also helps reach equilibrium in any market where it is commonly and extensively used [30]. With the development of the Internet, the process of market signalling has become more efficient, less costly and quicker.

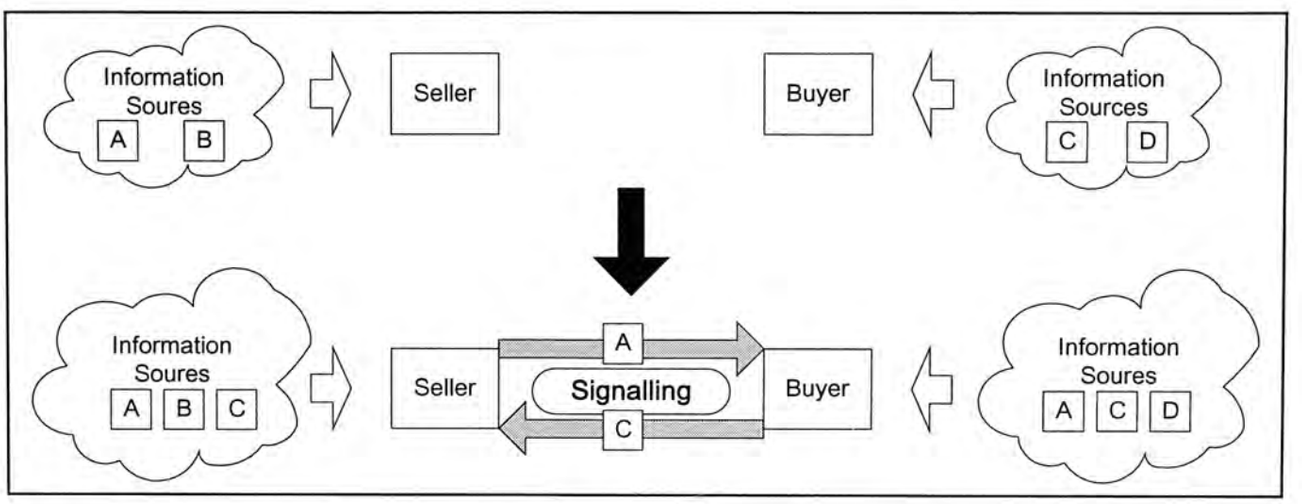


Figure 5-1. Selectively Send Signals to Opponents

Our system allows negotiators to send signals to their counter parties to create favourable impressions or strengthen their negotiation position. For example, recent transactions of similar property are a common, yet significant signal. In sending a signal, a party can selectively "leak" only the favourable information to his or her opponents, refer to Figure 5-1. The opponent can then adjust their reactions by better understanding the sender's intention and the reasons behind such action [31]. If the sender is credible, the opponent would react timely and consistently with the signals he or she has received. Market signalling can provide significant competitive advantages for the negotiators. It facilitates the communication among negotiators and leads to more efficient and transparent negotiation.

CHAPTER 6

6. SYSTEM

6.1 System Design

In demonstrating our proposed model, we have developed a prototype of marketplace implementing the functions in order to support all the processes involved for negotiation. It allows us to observe how a user acts throughout the entire process of a transaction, from searching a desired property to bringing an agreement. The system is a web-based application that supports multiple-negotiations among the users. That is, each potential seller can negotiate with more than one potential buyer independently at the same time.

6.2 Overview of the Transaction Process

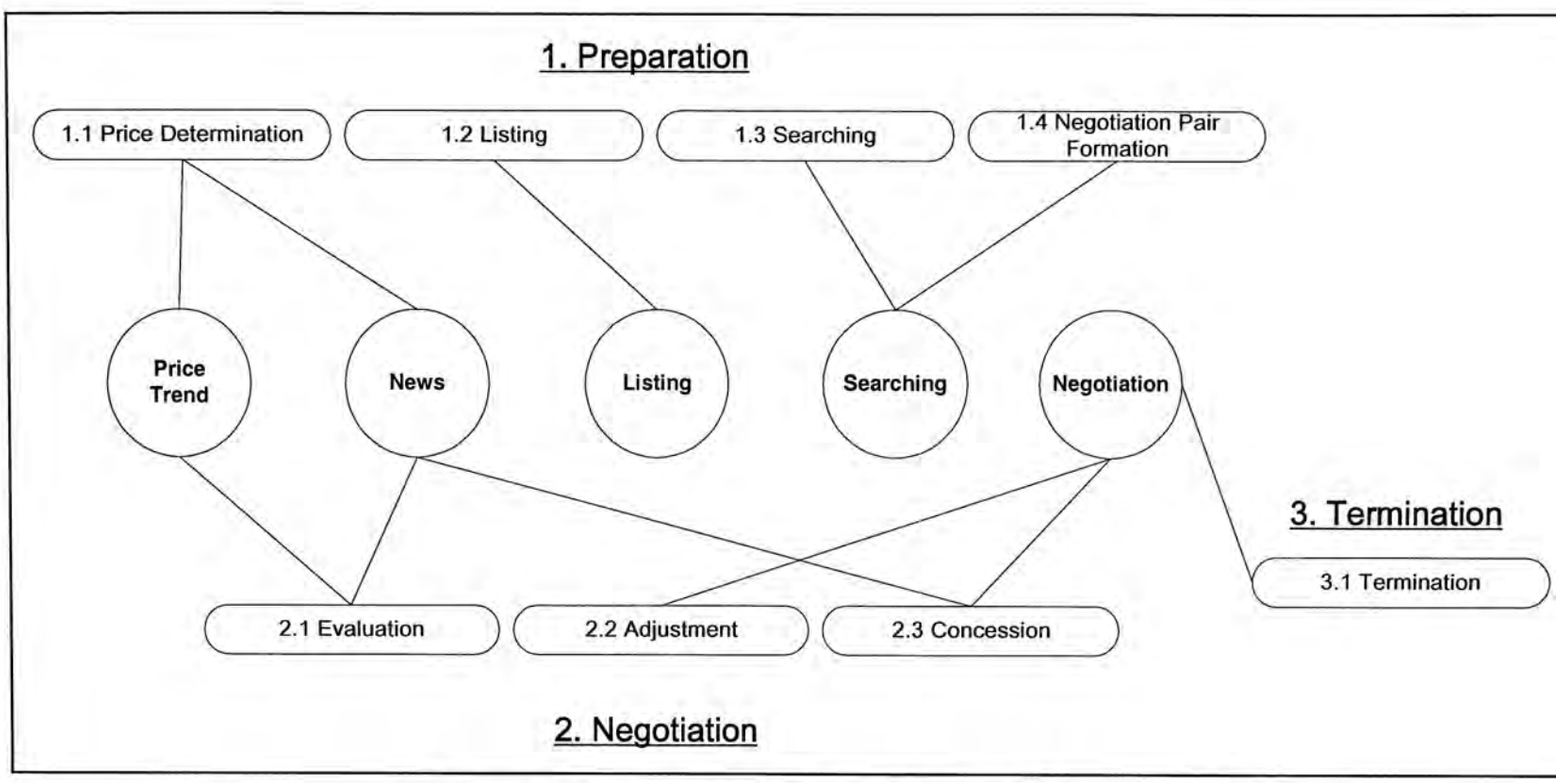


Figure 6-1. Overview of the System Transaction Process

The following sections describe in more detail about how our system supports the transaction process based on the model of negotiation.

6.2.1 Preparation

The stage of preparation involves price determination, listing, searching and negotiation pair formation. Our system provides two types of market information for

the user to determine the initial bid/ask price, those are the textual and numeric data from the sections of [News] and [Price Trend] respectively. Users can determine the current market price and the future price trend of their desired property so as to help determine their initial bid/ask price for negotiation.

The sections of [Property Listing] and [Property Searching] respectively support listing and searching of property. Once the buyer "picks" the desired property from the searching result, the negotiation pair between the buyer and the seller would be formed automatically. Moreover, the seller would then be notified with the initialization of negotiation by a system alert message in the section of [Alert].

6.2.2 Negotiation

The part of [Negotiation] supports most of the features for the negotiation process. The details of negotiation are shown in this part of the system as well.

6.2.2.1 Evaluation

The information concerned for evaluation, and from which part of system such information can be obtained, are described as follows.

- "Signals" from counter party – inside the section of 'Message', the user can view the messages sent and the news articles forwarded by the counter party.
- Textual and numeric data – as mentioned previously, these two kinds of information can be obtained in [News] and [Price Trend] respectively.
- Rating of counteroffer and recommendation price – they are directly shown in the table for negotiation details in [Negotiation].

6.2.2.2 Adjustment

This is to change the negotiator's limit, that is, the reserved price for the negotiation. In [Negotiation], by clicking the calculated 'Rating' of the counteroffer, it then enters the section in which the reserved price can be changed. After updating the reserved price, the rating of the counteroffer would be updated immediately as well. This is because the calculation of rating is based on the reserved price, so that once the reserved price is changed, the rating would be changed accordingly.

6.2.2.3 Concession

The process of concession refers to changing the offers (bid/ask price), and market signalling. To change the bid/ask price for the negotiation, the user can simply enter the new price into the system in [Negotiation] and the counter party would be able to

view the change immediately. For market signalling, the user can type and send some messages, or forward some favourable news articles to their counter party. With the feature of 'Messages' in [Negotiation], the user can type in their messages and then send to their counter party, as well as reading the messages received from their counter party. In order to forward news articles, users have to enter the section of [News]. In this part of the system, once the user has picked an article to read and found it favourable, he or she can forward it to their counter party. The user can forward only one article, but to more than one counter party, at a time.

6.2.3 Termination

For the active termination of negotiation, user can accept the counteroffer by clicking the 'Accept' button for a particular negotiation in [Negotiation]. Then, a successful transaction is executed at the price offered by the counter party, that is, the current bid/ask price from the counter party. Alternative, the user can choose to quit a negotiation by clicking the 'Delete' button such that the negotiation would be removed from the ongoing negotiations table.

If the negotiation is terminated by another party, the user would be notified by a system alert message and he or she has to enter [Alert] in order to check the message for details.

6.3 Functionality

This section describes the major functionality and features of our system and the implementation of each function. The interfaces of the major functions are shown in Appendix B1-B10.

6.3.1 Price Trend

For each residential estate in our database, the data of their transaction price over the past one to two years have been collected. The data of each real estate is plotted and represented into a chart. Our system also provides hyperlinks to other sources of property transaction data.

6.3.2 News

Apart from system downloaded news articles, there are also hyperlinks to websites of some online newspapers. If the users read some favourable news, they can signal their counter party by sending that particular news article to them. The user can send the same news article to more than one opponent at the same time. However, such feature only applies to the system news articles but not those in other websites.

6.3.3 Property Listing

The system allows the potential seller to register their property for sale. The property is then added into our database and can be searched by some potential buyers later on.

Each property, as long as it is not yet sold nor withdrawn from the owner, will be searched and selected by more than one potential buyer. In other words, for a particular property, the owner can negotiate with different buyers at the same time, but only one transaction can be made with one of the competing buyers.

6.3.4 Property Searching

The system allows the potential buyer to search for their desired property from the database of all registered properties. Buyers can set their criteria according to their own preferences. From the searching result, buyers can select the property they are interested and start negotiation with the owner. Each buyer can select more than one property and therefore, they can negotiate with more than one potential seller for different properties at the same time.

6.3.5 My Property

The part of the system is designed for the property owners, in which all their registered properties are summarized so that they can have a clear overview of their properties on hand. The properties are divided into three categories: idle, active, or sold.

Initially, all the registered properties are classified as "idle". For those properties which have been selected for negotiation, their status is automatically changed to "active". Once a transaction is made and a property is sold, its status is then updated to "sold". For an "active" or a "sold" property, its details cannot be changed.

6.3.6 Alert

System alert messages are automatically sent to the user under the following circumstances:

- To notify a property owner if someone is interested in his or her property and has selected it for negotiation.

- When a transaction is made, both the seller and the buyer would receive the alert message for the confirmation of transaction. If a property is negotiated by more than one potential buyer with the owner, once the transaction is made with any one of the potential buyers, all the others would be informed that the transaction is closed and they would be automatically withdrawn from that negotiation.

6.3.7 Negotiation

This is the core part of the system to support most of the features for the negotiation process. It also shows a clear summary of all the negotiations a user has already made.

There are four types of negotiation:

1. Ongoing negotiation – the user is still negotiating for a certain property with one counter party or more. It is further divided into two groups according to the position of the user in the negotiation, that is, whether he or she is the seller or the buyer.
2. Completed negotiation – when a user has compromised on a price and accepts the offer, the negotiation is said to be successful and a transaction is executed afterwards. On the other hand, for the user whose offer has been accepted by his

or her counter party, that particular negotiation is regarded as "completed negotiation" as well.

3. Closed negotiation – once a completed negotiation is made between a buyer and a seller, all other negotiations for the same property, if any, would then be ceased and have a "closed" status.
4. Deleted negotiation – when one party decides to quit negotiation, the other party is forced to cease the negotiation as well, and both parties would have the negotiation moved to the table of "deleted negotiation".

In both tables for ongoing negotiations, the following functions are supported.

Concession

- Update offer – a buyer can update the bid price while the seller can update the ask price.
- Signal – user can read the messages and news articles sent by their counter party. They can also type and send their messages in order to respond to the counter party.

Adjustment

- Update reserved price – they need to click on the value of "Rating" and enter the section in which they can type in their new reserved price.

Evaluation

- View the recommendation price and rating of the counteroffer. Their value is updated automatically whenever there is a change in the bid price, the ask price or the reserved price.

Termination

- Make transaction – by accepting the offer from the counter party.
- Quit negotiation.

CHAPTER 7

7. EXPERIMENT AND RESEARCH FINDINGS/EVALUATION

7.1 Objectives

In order to test the usefulness of the system, we conducted an experiment. In this experiment, subjects have simulated the process of property transaction using our system in order to make observations for the negotiation process. The objectives for the experiment are:

- To investigate how the pattern of obtaining information by the user would affect the negotiation process.

- To investigate how the type of the information (numeric/textual data) would affect the negotiation process. To compare their effect and importance to decision making.

For the pattern of obtaining information, we concern about when the user has accessed the information and the amount obtained for each access. For the negotiation process, we concern about the pattern of concession, the duration and the outcome of negotiation. The pattern of concession refers to the progression of each round of negotiation. We observe the time interval, and the price difference of the offer, between two consecutive concessions from each party. Duration of negotiation refers to the total time spent on negotiation, that is, from the initialization of negotiation to its termination. There are two possibilities for the outcome of negotiation – (i) successful, to execute a transaction, or (ii) failed, to halt without any agreement. For the successful negotiation, we also concern the transaction price.

Besides the pattern of obtaining information, we also concern about the type of information obtained. The information is classified into two categories, textual and numeric. Textual information refers to the news articles about the property market while numeric information refers to the transaction data for the real estates.

In general, we investigate how the different type of information available at a specific time would affect the decision of the negotiators during the negotiation. We intend to relate the concession of each party to the access of information. For a

concession from either party, we determine the type of information accessed and the amount obtained around the time at which the concession is made. We suppose to find out the general pattern of concession against the acquirement of different types of information. We then compare the total amount of the two types of information obtained during the negotiation in order to find out which type of information is more useful to support decision making.

7.2 Design of the Experiment

The specific time of accessing the textual and numeric information is determined by the time of entering the sections [News] and [Price Trend] respectively in the system. The amount of information obtained refers to the time spent on reading the information. Therefore, it is determined by the total time spent in each section.

It is important to keep track of all the access of information since it is a core part of our observation. We have to restrict the access of information such that all the relevant information should be obtained on-line, and through our system as well. If the users want to access any different sources of information, they need to provide that URL and our system will redirect them to those websites. Therefore, we can still keep track of the time spent on obtaining information from other sources.

7.3 Overview of the Experiment

In this experiment, we observe the progress of a few negotiation pairs. Therefore, we selected different housing estates from different regions in Hong Kong, such as, Kowloon and Hong Kong Island. We selected "active" real estates, that is, those with high transaction rate and high exposure on the Internet and on printing media. Half of the participants were assigned to be the property sellers while the other half the buyers. Each pair of seller and buyer was randomly selected to negotiate over one of the housing estates.

Except for the specific housing estates being assigned to the seller, all the other details of the property, as well as the ask price were determined by the seller. In most cases, sellers browsed our system to set up the initial bid price. Those buyers also had to determine the initial bid prices for the properties they were interested. They initialized negotiations by picking properties from the list of all properties. Optionally, apart from the assigned property, each buyer could select extra properties to minimize the risk.

Once a negotiation started, the participants were asked to negotiate with their counter parties to reach transactions within a one-week period. Within this negotiation period, they were required to logon the system frequently and respond to their counter parties. Also, they had to collect information through the system to support their decision making.

When time was up, all participants were required to terminate any ongoing negotiations, either by accepting the counteroffer to make a transaction, or just abandoning the negotiation.

7.4 Results and Findings

We have obtained seven successful transactions from the negotiations and the statistical data of the experiment is shown in the following tables.

Negotiation	Total Amount of Information Obtained (min)						Number of Signals		
	News			Price Trend					
	Seller	Buyer	*Total*	Buyer	Buyer	*Total*	Seller	Buyer	*Total*
N1	60	71	*131*	14	15	*29*	8	8	*16*
N2	55	65	*120*	12	16	*28*	5	4	*9*
N3	58	71	*129*	14	18	*32*	6	6	*12*
N4	87	65	*152*	22	14	*36*	10	10	*20*
N5	85	90	*175*	19	21	*40*	11	14	*25*
N6	123	99	*222*	33	21	*54*	8	10	*18*
N7	110	92	*202*	26	23	*49*	13	14	*27*

Table 7-1. Statistics for Negotiation (I)

Negotiation	Rounds of Negotiation	Duration of Negotiation (Hour)	Difference from Average Market Price (%)
N1	4	58	9.78
N2	4	53	24.34
N3	5	68	12.55
N4	5	44	7.29
N5	4	48	4.65
N6	7	34	8.42
N7	7	38	3.97

Table 7-2. Statistics for Negotiations (II)

In general, negotiators rely more on the textual information (news), rather than on the numeric information (price trend), to evaluate the current market conditions. One possible reason is that the transaction data of the property is rather stable than the news. The price trend of the property is in a monthly basis. Therefore, it is not supposed to have much fluctuation within the same month. Moreover, even for the active real estates, they are not likely to have many new transactions executed within a short period of time.

In contrast, the daily news is more volatile than the transaction data. Negotiators can better learn from the news the current market situation. Apart from the facts acquired from the news, there are also some editorials or analyses about the market trends from the textual information. Negotiators can then consolidate a variety of viewpoints or opinions to determine their move in negotiation.

The following table shows the correlation of the difference between the average market price and the transaction price, with the amount of information and number of signals in the negotiations.

Correlation, r		Difference from Average Market Price
Amount of Information (News)	Seller	-0.638
	Buyer	-0.595
	Total	-0.648
Amount of Information (Price)	Seller	-0.589
	Buyer	-0.478
	Total	-0.611
Number of Signals	Seller	-0.861
	Buyer	-0.898
	Total	-0.892
Number of Rounds		-0.432

Table 7-3. Correlation for Market Price Difference

A large negative value is obtained for the correlation between the data. That is, the amount of information obtained and the number of signals exchanged during negotiation have a strong and reverse relationship with the difference between the transaction price and the market price. It implies that, if the users exchange more signals and obtain more information during negotiation, the transaction price is closer to the market price of the property.

CHAPTER 8

8. CONCLUSIONS AND FUTURE WORKS

8.1 Conclusions

In this thesis, we have ascertained a new definition for the property transaction process with a model of negotiation. Based on such foundation, we have developed a prototype of electronic marketplace with negotiation supports for the property transactions. Experimental results have proved that the system could increase the performance of the negotiation process as well as the outcome of the transaction.

In order to emphasize the important role of negotiation, the transaction process is divided into three main stages, namely preparation, negotiation and termination. Preparation involves price determination, listing, searching and negotiation pair

formation. The stage of negotiation involves three sub-processes, which are evaluation, adjustment and evaluation. Termination of a transaction process is categorized into "completed", "closed" and "quitted".

In our model of negotiation, we assumed a direct negotiation between the negotiating parties, with no middleman involved. We adopted a two-stage negotiation approach in which the negotiators would first settle the less important terms and then focus on the most important one, that is, the price of the property. We also devised a utility function for property matching in the searching process.

We categorized the information needed for negotiation into two main types – textual and numeric information. Textual information refers to the latest news about the property market while numeric information refers to the price trend and other transaction data of the property. Additionally, we employed the features of signalling to the negotiation process. In sending a signal, a party can selectively "leak" only the favourable information to his or her opponents.

Based on the definition of the transaction process and the model of negotiation, we implemented all the necessary functions and features into a web-based system, that is, the prototype of the electronic marketplace with negotiation supports.

Our system was evaluated by simulating the transaction process in the electronic marketplace. Experimental results showed that computer-mediated

negotiation supports could enhance the quality of online business transactions, in terms of the transaction price and the duration of the whole transaction process. Moreover, it indicated that the access of information does affect the pattern of making concession in negotiation.

8.2 Future Works

Fundamental functions and features for computer-mediated negotiation have been provided in our proposed system. However, there are still a lot of rooms for improvement in the future.

For example, price prediction and forecast on a property based on its transactions can be used to enhance decision support for the user. What has been used was price trend analysis.

With the use of the push technology and intelligence agents, the system will be able to provide a dynamic and proactive supply of information to the user. The system can search from various websites for the most up-to-date news articles about a specific property, and then automatically forward to the users negotiating for that property.

Our system only allows the users to view the latest ask price and bid price of the negotiation. If all the previous offers and counteroffers can be shown in the form of a chart, it will enable the negotiating parties to observe how the negotiation has been going in order to support their decision making.

Appendix A Algorithm for Property Matching

For each property from the database of outstanding selling property
{
    For each attribute of the property
    {
        If N = 0, u = u + 0

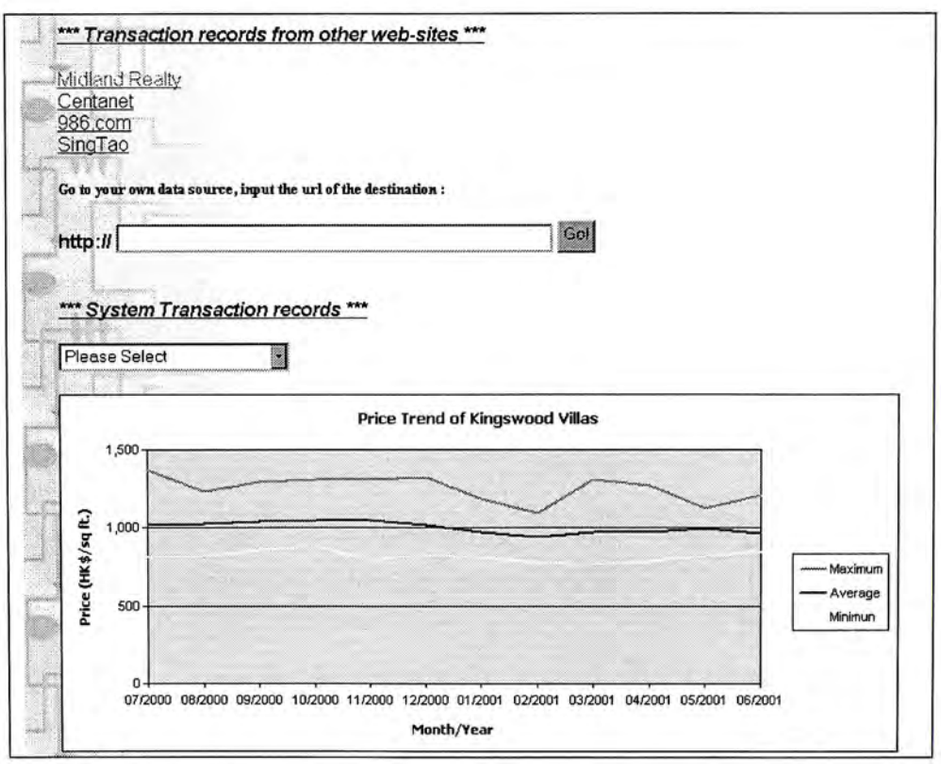
        If N = 2
            W = W + w
            If AS(s,b) → u = u + w*θ
            If not AS(s,b) → u = u + 0, non_neg++

        If N = 1
            W = W + w
            If AS(s,b) → u = u + w*θ
            If not AS(s,b) → u = u + w*θ, neg++
    }

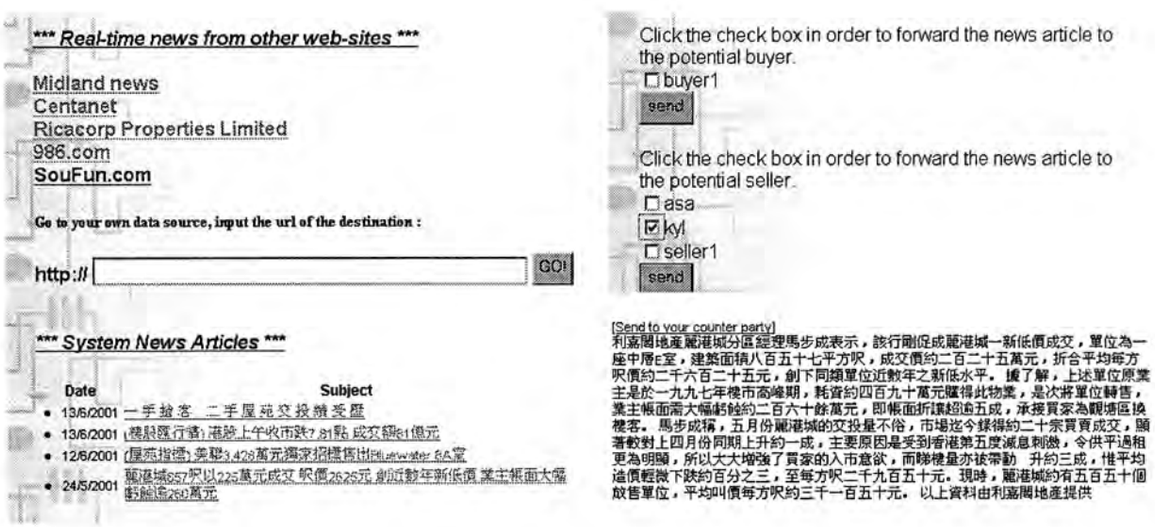
    if non_neg = 0 & neg = 0 → put that property into the 1st round searching result
    if non_neg = 0 (& neg > 0) → put that property into the 2nd round searching result
    if non_neg > 0 → put that property into the 3rd round searching result
}

u = u * 100% / W

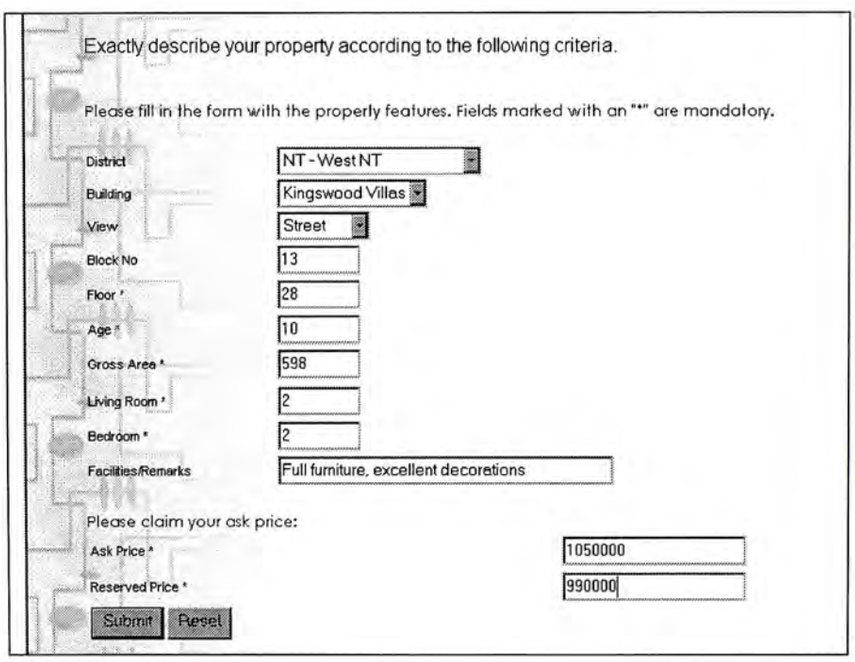
Appendix B1 Price Trend



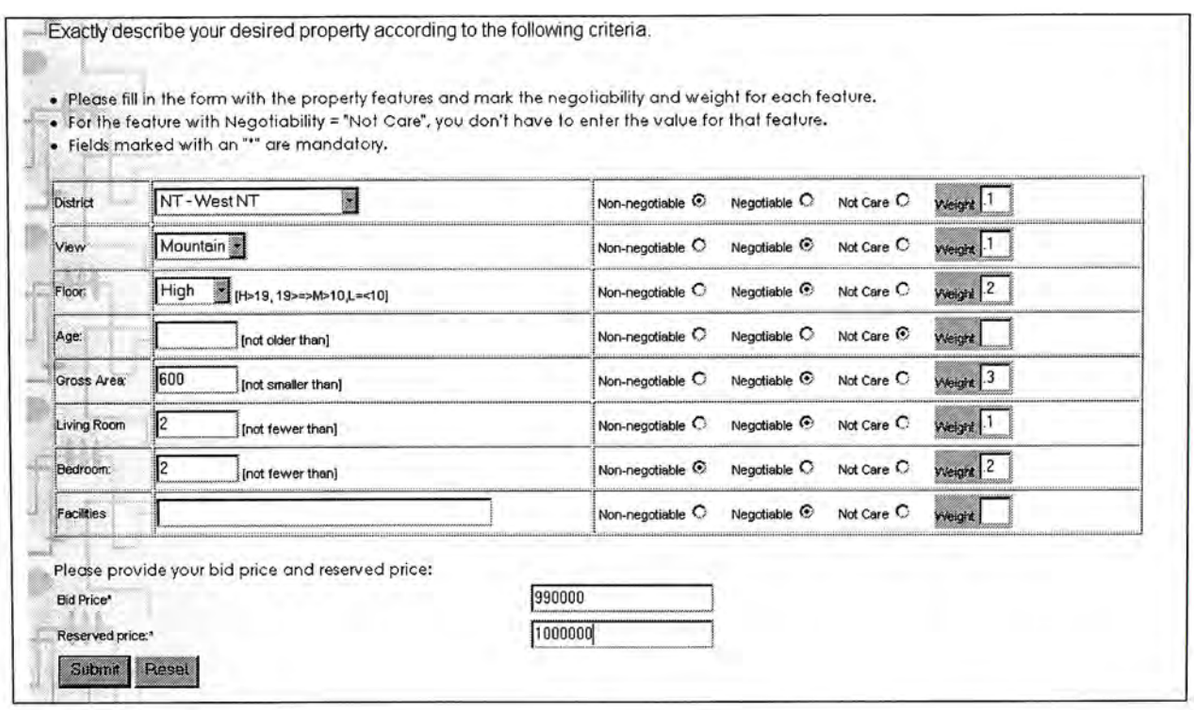
Appendix B2 Reading and Sending News Articles



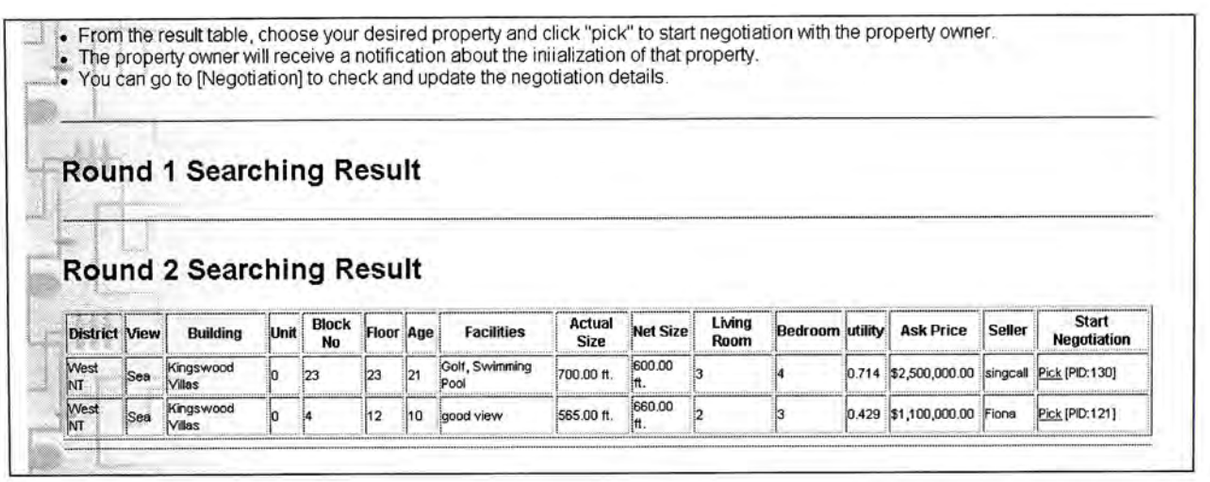
Appendix B3 Property Listing



Appendix B4 Property Searching



Appendix B5 Searching Result



- From the result table, choose your desired property and click "pick" to start negotiation with the property owner.
- The property owner will receive a notification about the initialization of that property.
- You can go to [Negotiation] to check and update the negotiation details.

Round 1 Searching Result

Round 2 Searching Result

District	View	Building	Unit	Block No	Floor	Age	Facilities	Actual Size	Net Size	Living Room	Bedroom	utility	Ask Price	Seller	Start Negotiation
West NT	Sea	Kingswood Villas	0	23	23	21	Golf, Swimming Pool	700.00 ft.	600.00 ft.	3	4	0.714	$2,500,000.00	singcall	Pick [PID:130]
West NT	Sea	Kingswood Villas	0	4	12	10	good view	585.00 ft.	660.00 ft.	2	3	0.429	$1,100,000.00	Fiona	Pick [PID:121]

Appendix B6 My Property

You have registered the following 3 properties into our database.

PID	District	Building	View	Block No	Floor	Age	Actual Size	Living Room	Bedroom	Facilities Remarks	Ask Price	Reserve Price	Status	Delete	Copy
150	West NT	Kingswood Villas	Street	13	28	10	598.00 ft.	2	2	Full furniture, excellent decorations	$1,050,000.00	$990,000.00	IDL	[X]	[Copy]
151	Central Kln	Mei Foo Sun Tsuen	Sea	125	11	23	895.00 ft.	2	3		$2,000,000.00	$1,920,000.00	SOLD		
152	East Kln	Laguna City	Mountain	20	2	10	664.00 ft.	2	2	Convenient, good location	$2,100,000.00	$1,950,000.00	ACT		

Explanation

PID - the property ID, unique for each property

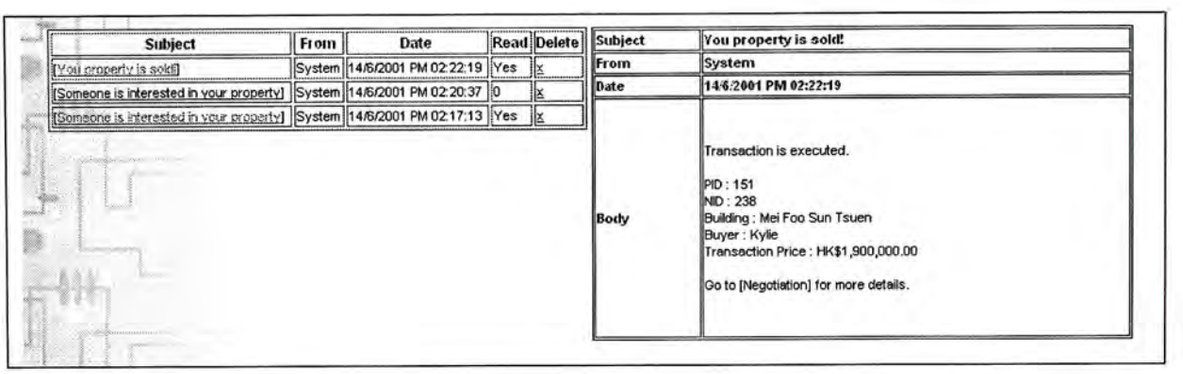
Status
"IDL" : idle, you can change the details of the property or remove it from our database.
"ACT" : active, your property is picked by a potential buyer for negotiation, you cannot change any details of the property nor to remove it from the database

Delete - click "x" in order to remove the property from our database

Copy - a new property will be duplicated with the same features of the original property

***** To change details of a property***
First click "copy" to duplicate the property. Then update the new property with the desired features and delete the original property. Therefore, each time you update the details for a property, its PID will be changed as well.

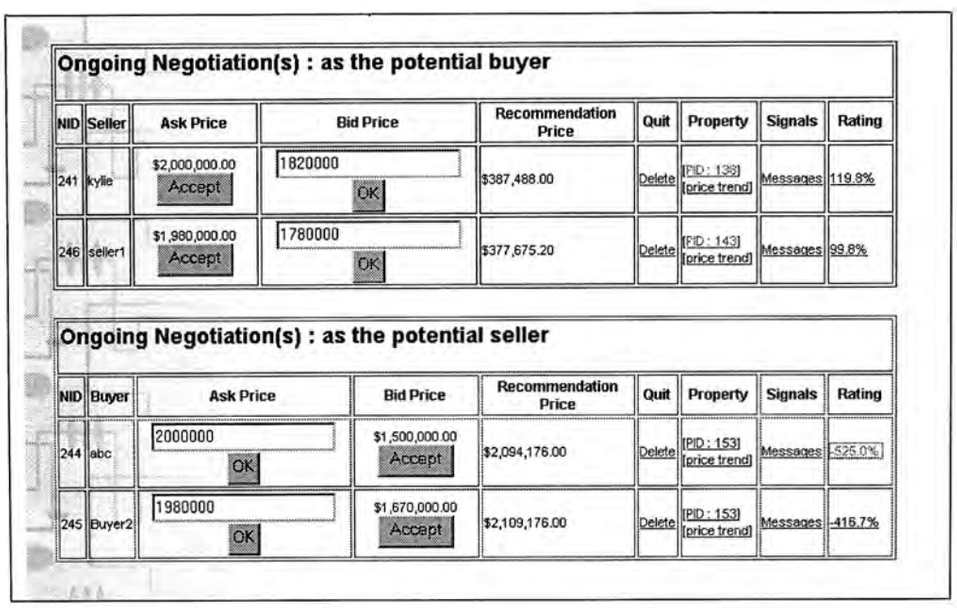
Appendix B7 System Alert



Subject	From	Date	Read	Delete
[You property is sold!]	System	14/6/2001 PM 02:22:19	Yes	x
[Someone is interested in your property]	System	14/6/2001 PM 02:20:37	0	x
[Someone is interested in your property]	System	14/6/2001 PM 02:17:13	Yes	x

Subject	**You property is sold!**
From	**System**
Date	**14/6/2001 PM 02:22:19**
Body	Transaction is executed. PID : 151 NID : 238 Building : Mei Foo Sun Tsuen Buyer : Kylie Transaction Price : HK$1,900,000.00 Go to [Negotiation] for more details.

Appendix B8 Ongoing Negotiations



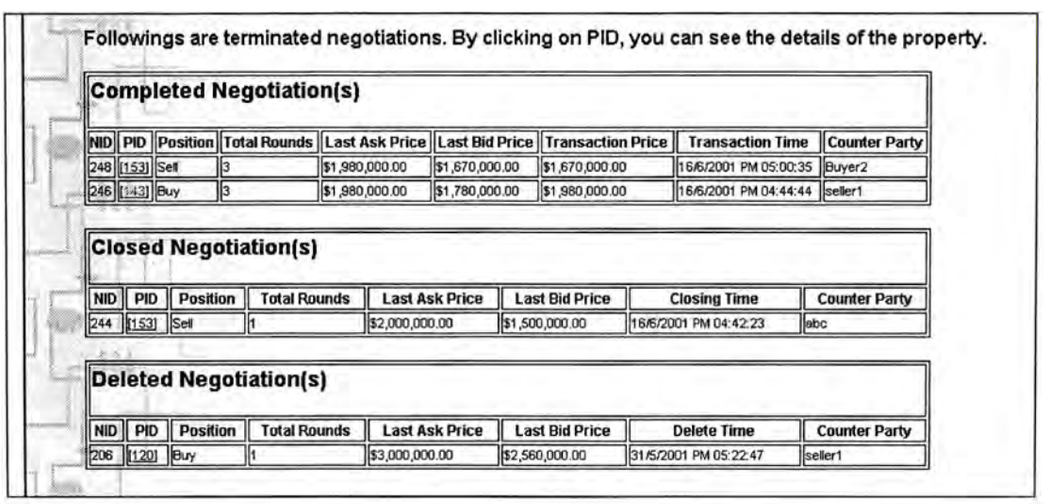
Ongoing Negotiation(s) : as the potential buyer

NID	Seller	Ask Price	Bid Price	Recommendation Price	Quit	Property	Signals	Rating
241	kylie	$2,000,000.00 Accept	1820000 OK	$387,488.00	Delete	[PID : 138] [price trend]	Messages	119.8%
246	seller1	$1,980,000.00 Accept	1780000 OK	$377,675.20	Delete	[PID : 143] [price trend]	Messages	99.8%

Ongoing Negotiation(s) : as the potential seller

NID	Buyer	Ask Price	Bid Price	Recommendation Price	Quit	Property	Signals	Rating
244	abc	2000000 OK	$1,500,000.00 Accept	$2,094,176.00	Delete	[PID : 153] [price trend]	Messages	-525.0%
245	Buyer2	1980000 OK	$1,670,000.00 Accept	$2,109,176.00	Delete	[PID : 153] [price trend]	Messages	-416.7%

Appendix B9 Terminated Negotiations



Followings are terminated negotiations. By clicking on PID, you can see the details of the property.

Completed Negotiation(s)

NID	PID	Position	Total Rounds	Last Ask Price	Last Bid Price	Transaction Price	Transaction Time	Counter Party
248	[153]	Sell	3	$1,980,000.00	$1,670,000.00	$1,670,000.00	16/6/2001 PM 05:00:35	Buyer2
246	[143]	Buy	3	$1,980,000.00	$1,780,000.00	$1,980,000.00	16/6/2001 PM 04:44:44	seller1

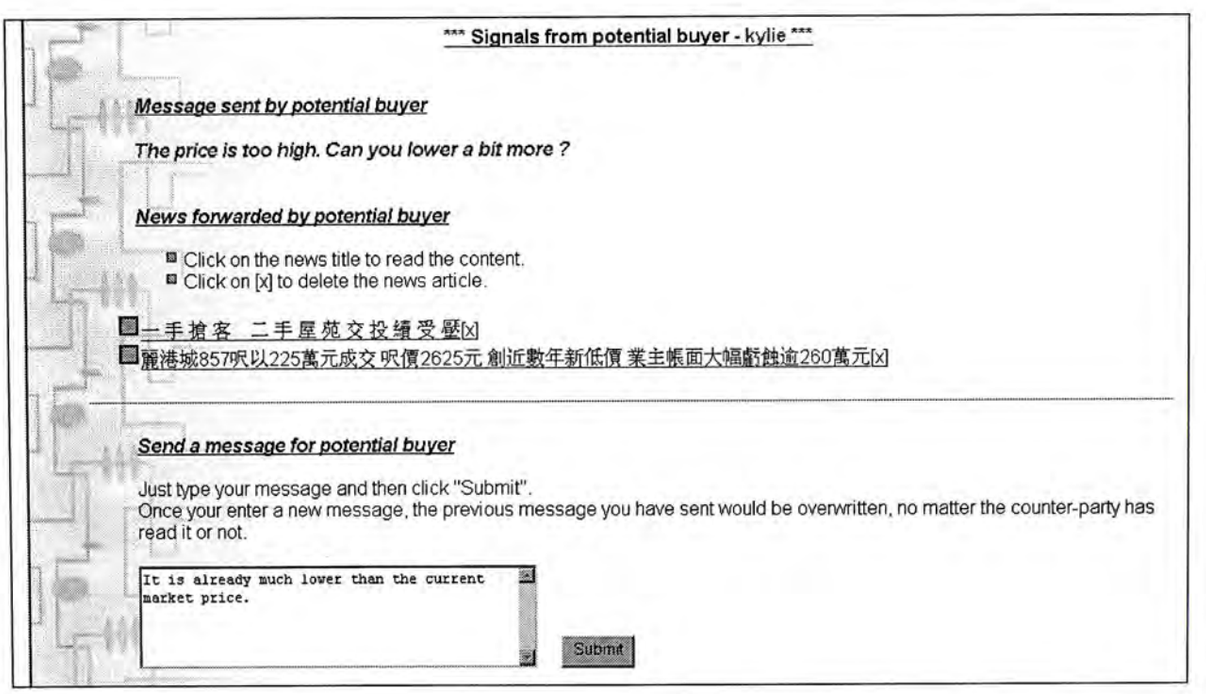
Closed Negotiation(s)

NID	PID	Position	Total Rounds	Last Ask Price	Last Bid Price	Closing Time	Counter Party
244	[153]	Sell	1	$2,000,000.00	$1,500,000.00	16/6/2001 PM 04:42:23	abc

Deleted Negotiation(s)

NID	PID	Position	Total Rounds	Last Ask Price	Last Bid Price	Delete Time	Counter Party
206	[120]	Buy	1	$3,000,000.00	$2,560,000.00	31/5/2001 PM 05:22:47	seller1

Appendix B10 Signalling



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